Triangle Universities Nuclear Laboratory

Precision Measurements of γ−Ray Attenuation Coefficients at HIγS

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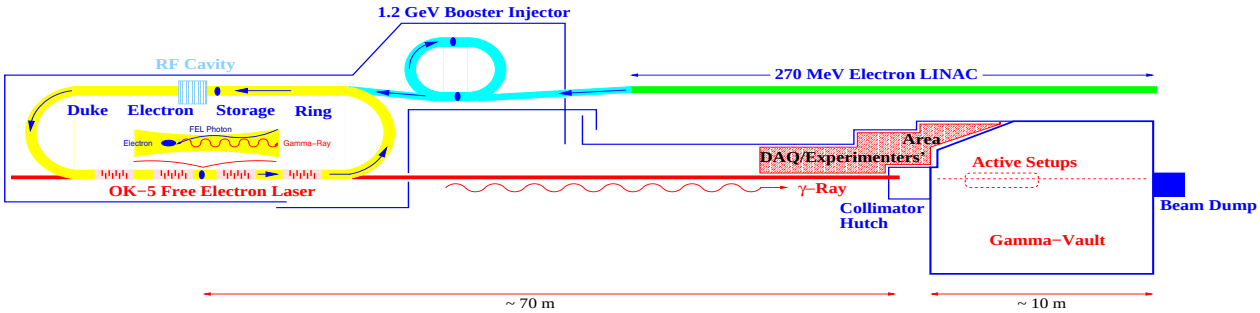
Motivation

- The need of the SBSS program to quantitatively measure density profiles from radiographs using high−energy flash x−ray machine (PHERMEX);
- Present errors on total absorption cross−sections are ~2−3 %, which is too large when propagated through the transmission equation. Goal here is to reduce these errors to <0.5 %. An accuracy of ~ 0.2 % has been achieved (see Table below).

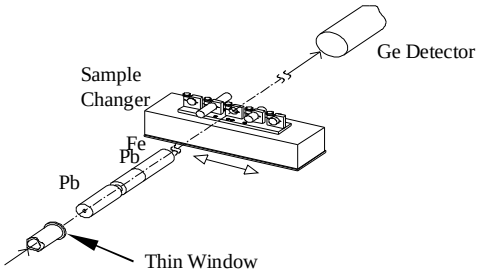


Schematic of the storage ring and FEL used to produce the gamma−ray beams

HIGS Performance

	Current ;	Booster Injector (~late 2005)
Energy	2−50 MeV	2−225 MeV
Flux γ/sec	10^5–10^8	10^8–10^9
Polarization	Linear	Linear & Circular

Measurements have been performed on Be, C, Ta, W, Pb, depleted U. More samples, especially actinides, need to be measured. Support is needed to enable HIGS/Duke University to handle special nuclear materials.



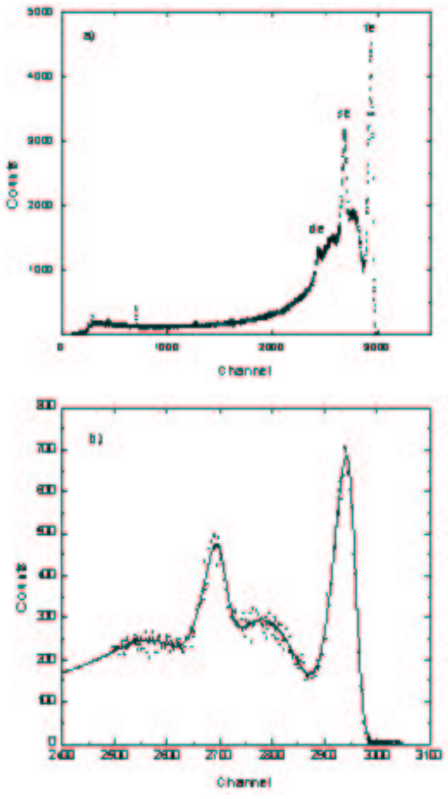
Setup for γ−ray attenuation measurements.

HIGS Measurement

E(MeV)	σ(b) HIGS	σ(b) NIST
5.98 +/− 0.04	3.255+/− 0.007	3.28

Future

Additional measurements of differential cross−section as a function of angle are needed. A scoping experiment designed to look at the feasibility of this is in the planning stage.



a) HIGS spectrum at 6 MeV, no sample; b) Cu sample two attenuation lengths thick.

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